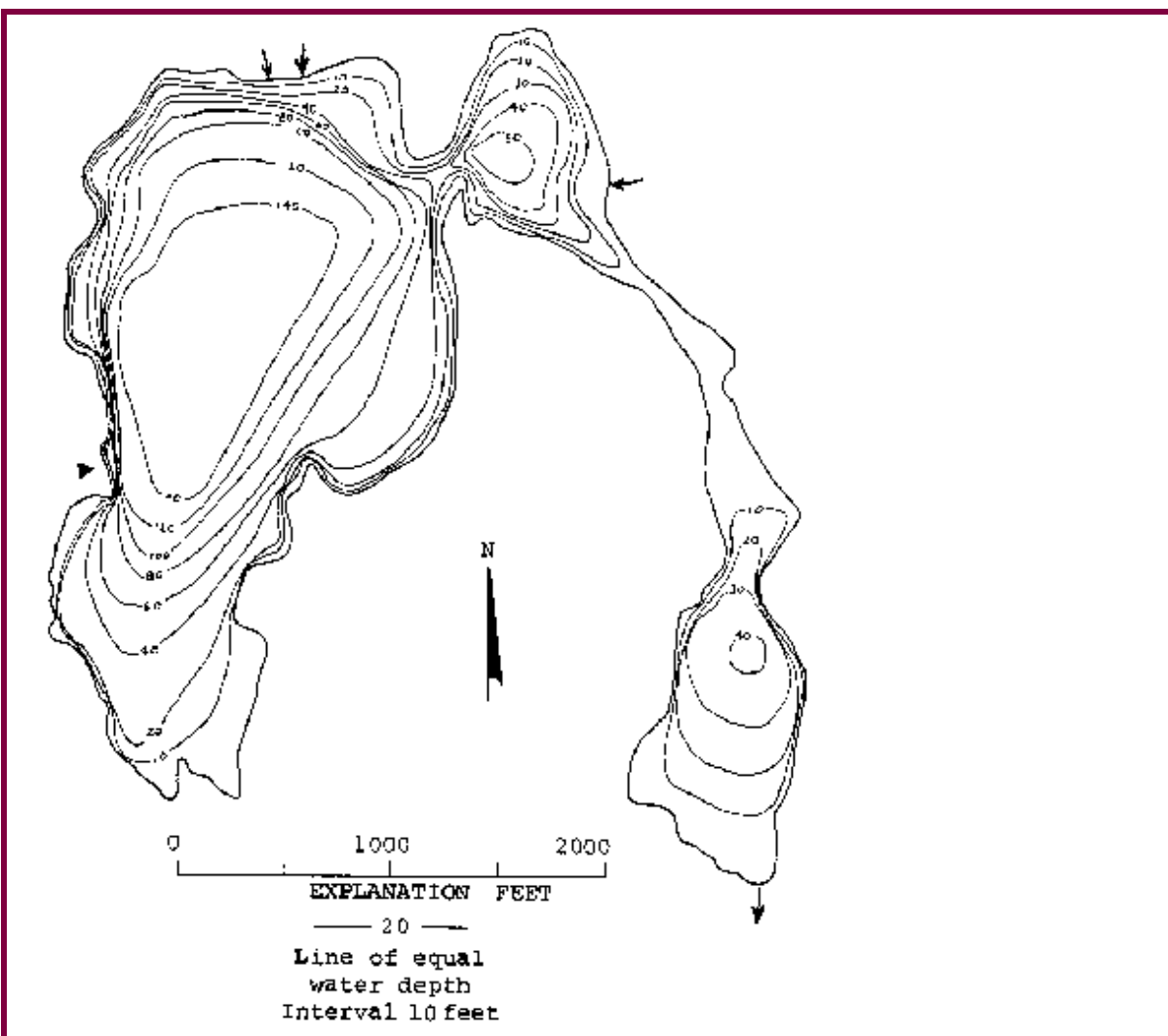# HORSESHOE

PEND OREILLE County

Lake ID: HORPE1

Ecoregion: 8

Horseshoe Lake is approximately 25 miles northwest of Spokane located near the corner where three counties (Spokane, Pend Oreille and Stevens) meet. It is fed by Heel and Buck Creeks and drains to the Little Spokane River through Eloika Lake.

Area (acres)	Maximum Depth (ft)	Mean Depth (ft)	Drainage (sq mi)	
141	150	64	80	

Volume (ac-ft)	Shoreline (miles)	Altitude (ft abv msl)	Latitude	Longitude
9002	3.84	1975	48 06 19.	117 24 28.

N

0   1000   2000

EXPLANATION FEET

—— 20 ——

Line of equal
water depth
Interval 10 feet

Station Information

Primary Station	Station # 1	latitude: 48 06 41.0	longitude: 117 25 10.0
	Description:	Deep part of lake, directly north of boat launch	

Trophic State Assessment   for   1998

HORSESHOE

Analyst: KIRK SMITH

TSI_Secchi:	47	N
TSI_Phos:	45	
TSI_Chl:	62	
Narrative TSI:[a]	ME	

The trophic state of Horseshoe Lake is probably near natural conditions. Results from the watershed and habitat surveys suggest there is relatively little anthropogenic disturbance and the meso-eutrophic state of the lake should be acceptable in supporting the uses of the lake. Questionnaires indicated a strong desire among respondents to restrict motorboat use as well as an appreciation for the scenery. Whether to restrict motorboat use is largely an aesthetic decision; the shoreline is not particularly susceptible to erosion from motorboats. The lake should support an excellent coldwater fishery. It is productive yet retains a very cold and mostly oxygenated hypolimnion. There was only slight evidence of internal phosphorus loading (in August). Average chlorophyll concentrations were higher than would be expected given phosphorus and transparency averages. Our early June chlorophyll reading was highest; this could have been the tail end of a spring response to under-ice nutrient release from senescing macrophytes.

Because uses are being supported and the trophic state of the lake is natural, a total phosphorus criterion may be set at the seasonal mean that was established during 1998 sampling, adjusted for interannual variability. Therefore, a nutrient criterion for the lake of 25.4 ug/L total phosphorus (mean 20.3 ug/L plus std. dev. of 5.1 ug/L) is recommended..

[a] E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

Chemistry Data

HORSESHOE

Date	Time	Strata	Tot P (ug/L)	Tot N (mg/L)	TN:TP	Chloro-phyll (ug/L)	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Calcium (ug/L)	Turbidity (NTU)
Station 0										
7/13/1998		L					1 J			
		L					1 U			
8/10/1998		L					3			
		L					1 U			
9/14/1998		L					2			

Station 1

Date	Strata						
6/15/1998	E	29.7	.178	6	33.5	19	3.3 J
	H	20.1					
7/13/1998	E	20.5	.414	20	13.8		2.5
	H	23.9	.192	8			
8/10/1998	E	18.4	.517	28	24.2		2.1
	H	62.8	.399	6			
9/14/1998	E	11.7	.229	20	4.2		.7
	H	14.4	.247	17			

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than

Watershed Survey

HORSESHOE

Survey Date: 9/14/1998

Land Uses (1 = Primary, 2 = Secondary, etc.)

	Agriculture(commercial, not hobby)	2	Residential
	Commercial, Industrial	1	Park, forest or natural
	Major transportation		

Impervious surfaces (Roads and parking area): No Curbs

Observations (check mark denotes presence)

BMP's ☐

Probably not too degraded from natural conditions and not too suceptible provided good forest practices. Shoreline is cobble/broken shale and probably not susceptible to erosion. 17 homes on lake--probably not many more in watershed.

Odors ☐

Cattle ☐   **Ducks** ☐   **Geese** ☐

Fertilizers and weed killers appear to be used in residential or agriculture area ☐

Buffer zones around streams and wetlands ☐

Irrigation ☐

Survey Id:

Habitat Survey Summary Report

HORSESHOE

Data are averages of *10* **Stations Surveyed**   **Date of Visit:**   7/13/1998

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	1.2	**Number of stations with canopy:**	10
Understory Avg:	2.4	**Number of stations with understory:**	10

Percent Areal Coverage   (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	trees > 0.3 m DBH	1.8
	trees< 0.3 m DBH	0.7
Understory:	woody shrubs saplings	2.0
	tall herbs, forbs grasses	1.8
Ground Cover:	woody shrubs seedlings	1.6
	herbs, forbs, grasses	1.2
	standing water or inundated veg	0.5
	barren or buildings	1.6
Substrate Type (within shoreline plot):	bedrock	0.3
	boulders	0.4
	cobble/gravel	1.8
	loose sand	0.8
	other fine soil/sediment	0.4
	vegetated	2.5
	other	0.2
Bank Features:	angle (O:<30; 1: 30-75; 2:nr vertical)	0.8
	vertical dist (M from wtrln to high wt):	0.1
	horiz. dist. (M from wtrln to high wt):	0.1

Human Influence   (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	0.6
commercial	0.0
park facilities	0.1
docks/boats	0.7
walls, dikes, or revetments	0.0
litter, trash dump, or landfill	0.0
roads or railroad	0.3
row crops	0.0
pasture or hayfield	0.0
orchard	0.0
lawn	0.0
other	0.0

Physical Habitat Characteristics

station depth (at 10 m from shore)	4.5

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.4

boulders	0.2
cobble	1.1
gravel	2.4
sand	0.9
silt	0.8
woody debris	0.6

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	1.5
emergent	1.0
floating	0.0
total weed cover	1.7
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-0.3

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	1.2
snags	0.1
brush or woody debris	0.9
inundated live trees	0.0
overhanging vegetation	0.4
rock ledges or sharp dropoffs	0.0
boulders	0.2
human structures	0.3

Questionnaire

<div align="right">HORSESHOE</div>

Results compiled from	6 **Surveys.**	**Average time (years) respondents spent on lake:**	7.33

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:	-0.2	View:	1.0	Distance to Lake:	0.5
Public Access:	-0.3	Swim Beach:	0.5	Canada Geese:	0.7
Water Clarity:	0.2	Water Qual. for Swim:	0.0		
Fishing Quality:	0.5	Aquatic Plants:	-0.2		

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today?　　　**3.5**

Which would you rather have, 1 or 2?

1) Better fishing and more natural habitat, or 2) clearer water?	1.2
1) Better fishing and more natural habitat, or 2) fewer aquatic plants?	1.3
1) Clearer water, or 2) fewer aquatic plants?	1.3

How important is each of the following characteristics to you (1 = very undesirable, 5= very desirable):

Restricted Watercraft:	4.7	Good Warmwtr Fishing:	4.0	Natural Scenery:	5.0
Plant Growth:	3.2	Good Swimming:	4.3	Public Beach:	2.2
Natural Shoreline:	4.2	Less Algae:	3.8	Canada Geese:	4.3
No Odors:	4.2	Public Access:	2.2		
Good Coldwtr Fishing:	4.0	Clear Water:	4.0		

Tabulated Results

Survey ID	Date	------------Residency------------		Rent or Own	Primary Activity*	Purchase Factor?	Has it Changed?	When?
						----------Water Clarity----------		
47	12/31/1998	Visitor			SEVERAL OF THE A	☐	Unknown	
60	8/10/1998	Resident	Permanent	Rent	several of the above	☑	Worse	5 to 10 year
	It is very desirable that the public launch be managed better because swimmers are using the launch at the same time people are attempting to launch boats. It would help to have gas motors banned.							
71	8/17/1998	Resident	Permanent	Rent	7	☐	Worse	1996
82	8/15/1998	Resident	Permanent	Rent	run a business	☐	No	
84	12/31/1998	Visitor			4	☐	No	
85	8/8/1998	Resident	Permanent	Rent	run a business	☐	No	

* 1=canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

HORPE1

Date 6/15/1998   Station: 1   Anabaena prevalent, 4 mLs observed
                  Sample ID 5

Number of organisms measured: 35

Group	Percent		Group	Percent
Cladoceran	20.0%		Small < 1mm	57.1%
Copepod	80.0%		Large >= 1mm	42.9%
Other			Ratio of large to Small:	0.75
			Average size (mm):	0.84

Aquatic Plant Data

HORSESHOE

Sampler: Parsons, O'Neal   Survey Date: 7/13/1998

Max depth of growth (M): variable ~3.5

Comments gusty wind, breeze, partly cloudy. Goose family, ducks, bullfrog, osprey nest on SE shore. Productive lake! Water greenish, heavy algae growth on most submersed plants. Dense plant growth in protected areas. Most places max depth of plant growth about 3 m.

SPECIES LIST

Scientific Name	Common Name	Dist [a]	Comments
Brasenia schreberi	watershield	2	patches, never dense
Carex sp.	sedge	2	shoreline
Ceratophyllum demersum	Coontail; hornwort	2	
Eleocharis sp.	spike-rush	2	shoreline
Elodea canadensis	common elodea	3	sometimes very dense, blooming
Juncus sp.	rush	2	
Nuphar polysepala	spatter-dock, yellow water-lily	2	at south end
Phalaris arundinacia	reed canarygrass	2	
Potamogeton amplifolius	large-leaf pondweed	2	
Potamogeton epihydrus	ribbonleaf pondweed	2	

|			
Potamogeton robbinsii	fern leaf pondweed	3	few dense areas in deeper water
Scirpus sp.	bulrush	2	
Typha sp.	cat-tail	2	

a 0 - value not recorded (plant may not be submersed)   1 - few plants in only 1 or a few locations
  2 - few plants, but with a wide patchy distribution   3 - plants in large patches, codominant with other plants
  4 - plants in nearly monospecific patches, dominant   5 - thick growth covering substrate to exclusion of other species

Secchi Depth and Profile Graphics

Station: 1

HORPE1
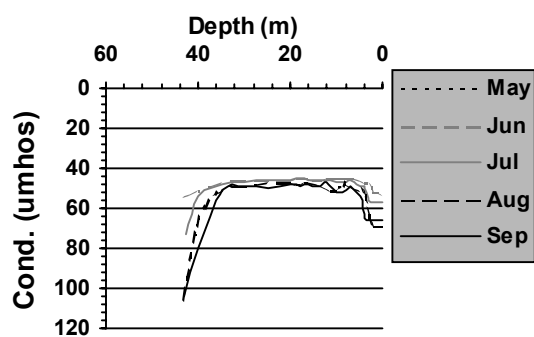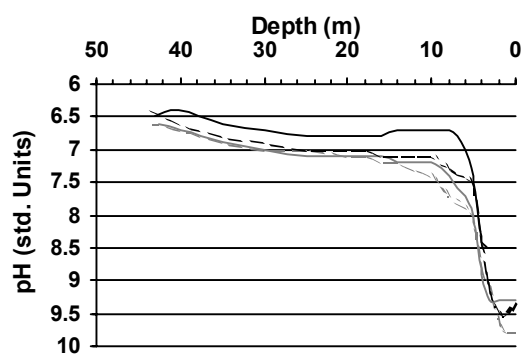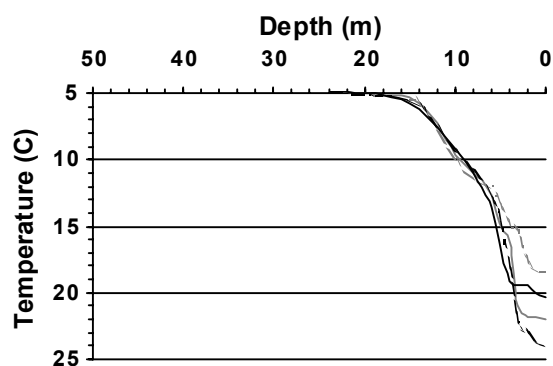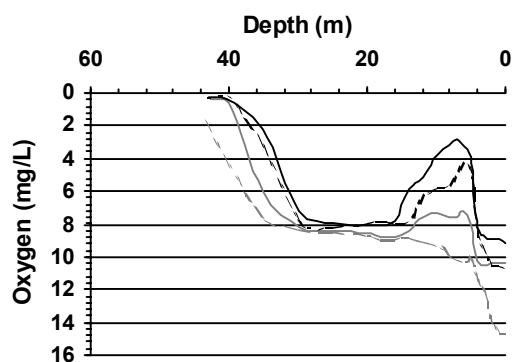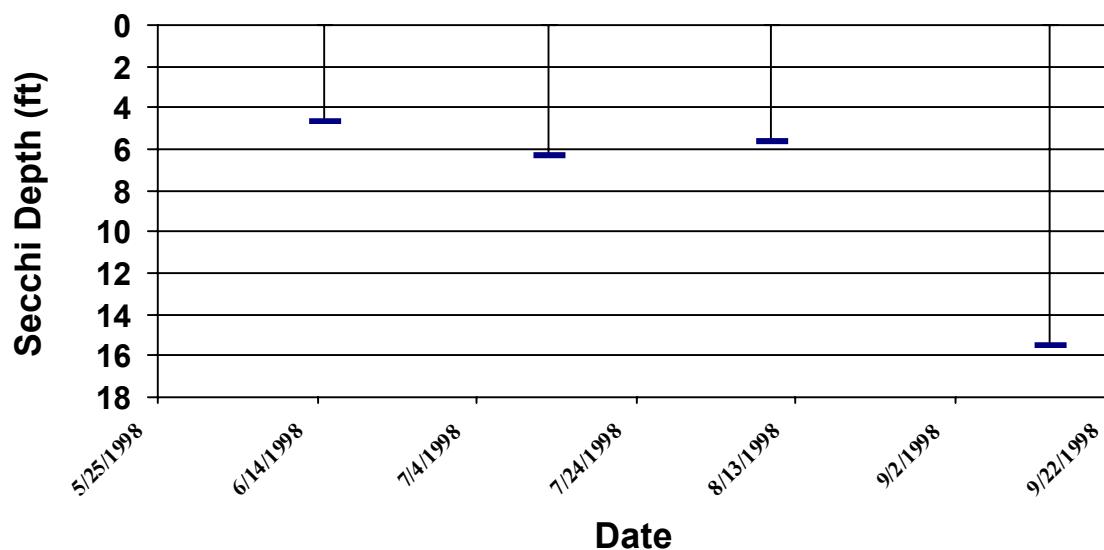
Date

Secchi Data and Field Observations

Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
Station 1													
6/15/1998			4.62	3	50	2	2	4	3	8	1	0	0
Sampler: HALLOCK					Remarks: APPROX. 20 HOMES SCATTERED AROUND SHORE. TIMBERED SLOPES, LOTS OF BEDROCK OUTCROPS AND CLIFFS. 1 RESORT. LOTS OF BLUE-GREEN IN THE WATER.									
7/13/1998			6.27	3	50	3		3	2	8	1	0	0
Sampler: HALLOCK					Remarks: AESTHETICS ARE FAIR BUT GOOD HABITAT FOR WILDLIFE. SMALL ALGAL COLONIES ABUNDANT. PEOPLE SWIMMING AT RESORT AND JUMPING OFF CLIFFS.									
8/10/1998			5.61	6	0	1		3	3	0	0	3	0
Sampler: HALLOCK					Remarks: H2S @ 40 M BUT NOT AT 10 OR 25 M. SOME BIRDS WADING AT ACCESS, ONE PERSON FISHING.									
9/14/1998			15.51	6	0	1		4	4	0	0	0	0
Sampler: HALLOCK					Remarks:									